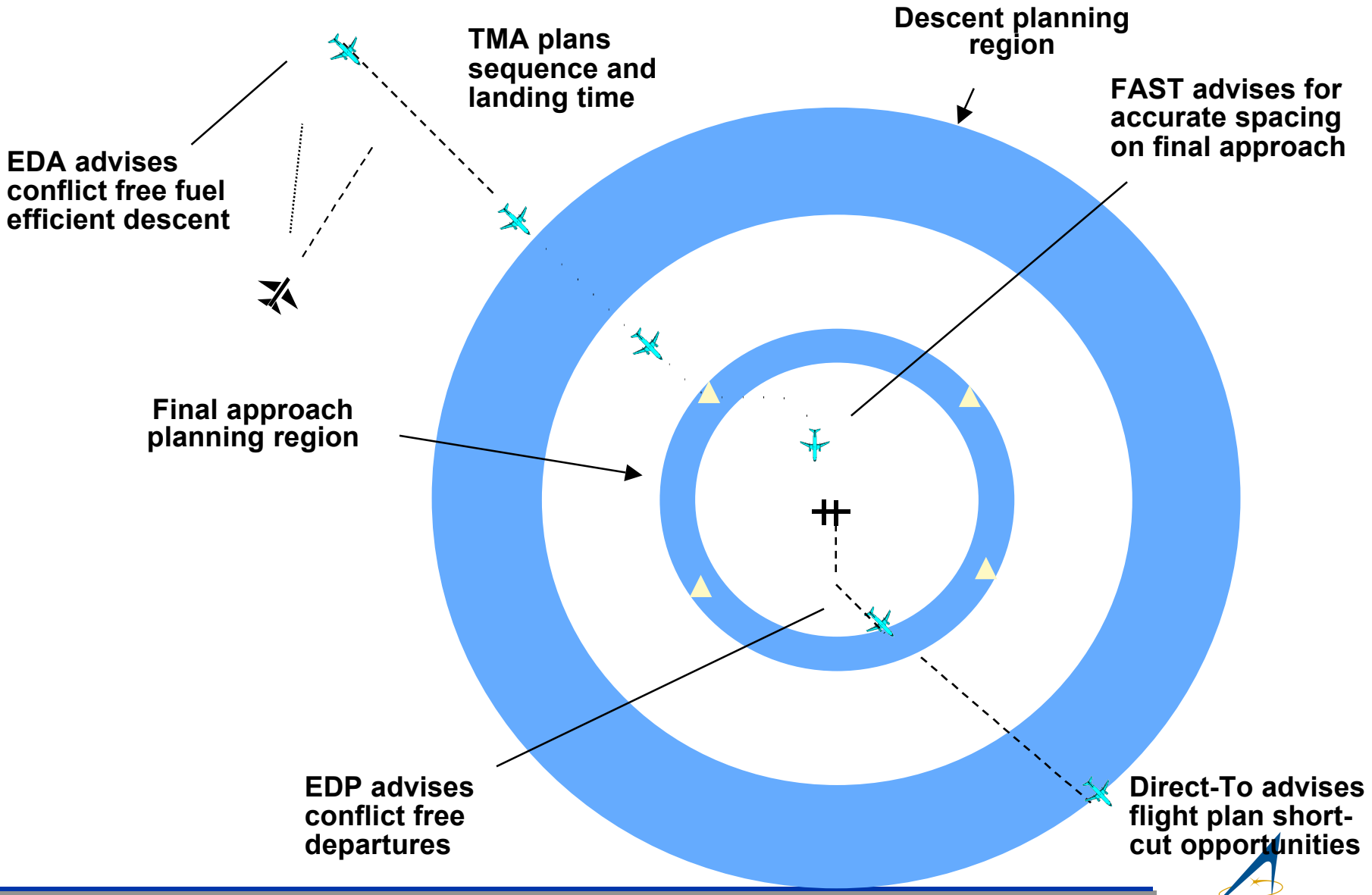
The Impact of IT on Air Transportation

Dr. Thomas A. Edwards
Chief, Aviation Systems Division
NASA Ames Research Center

Ames Research Center

CTAS – The First Phase of Automation



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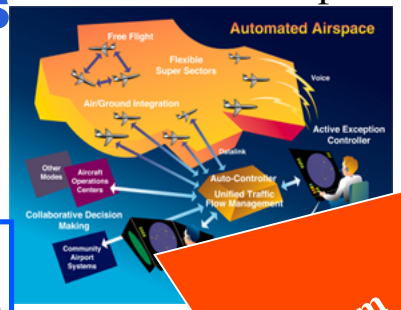
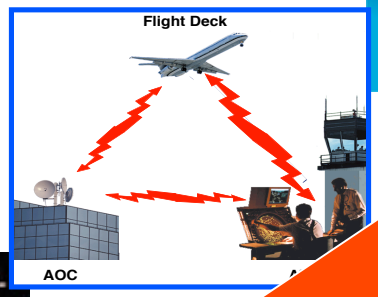
Revolutionary Advancements Made Possible Through IT

Automated Airspace

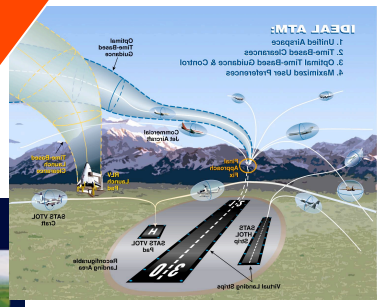


Improved Traffic Flow

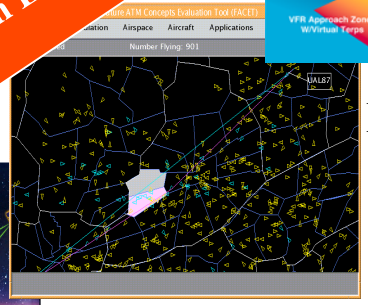
Air/ground Integration



Free Flight
DSTs



System-Wide
Optimization



Inclusion of
all Airports

Greater Automation/Precision of Information Leads to a More Deterministic System

Centralized Traffic
Flow Management

Improved System-Level
Monitoring and Diagnostics

CNS

Automaticity

(System wide optimization, separation assurance)

Precision

(Weather, System, Demand, Navigation, Surveillance)

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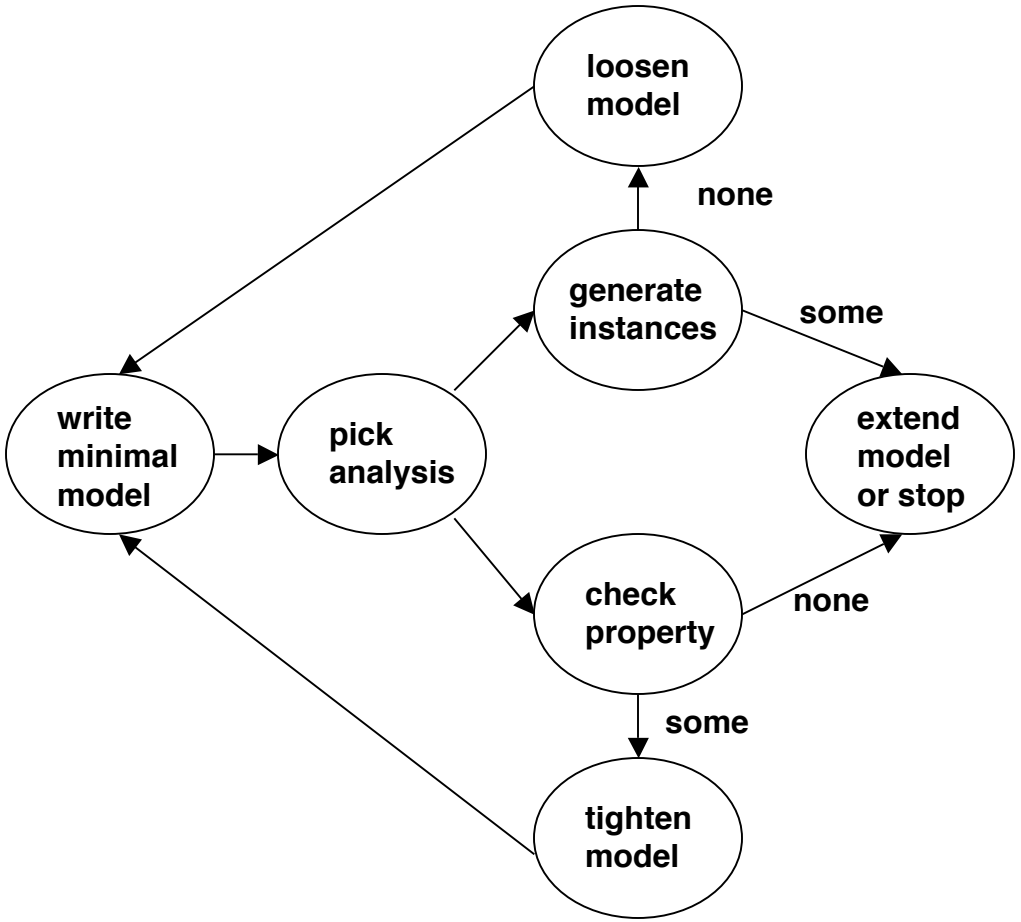
Certification of Future ATM Automation Systems

- Reliability requirements extremely high - no chance for human to recover system after failure
- Traditional testing approach inadequate: too many code paths untested; spec may be incomplete
- “Formal methods” provide math-based means to assess correctness of system behavior
- “Lightweight formalisms” less costly and allow focus on modeling key properties of system during all stages of development



Approach to Lightweight Modeling (Alloy language, MIT)

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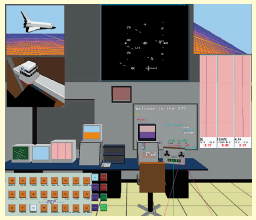
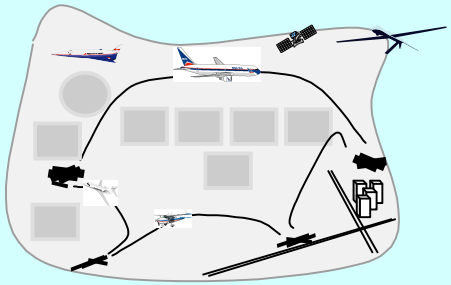
Concept Validation Through System-Level Simulation

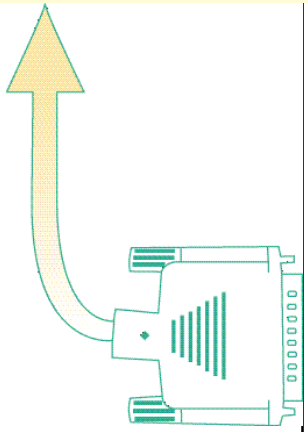
Collaborative Tools for System Level Assessments



Virtual Laboratories for Command and Control

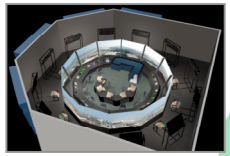


Future Air Transportation System



VMS

FFC



Flight and Tower Simulators

Training Centers

Rotorcraft Operations

FAA Tech Center

Network/Architecture Links Facilities

ATC

CVSRF

ATM and Human Factors Labs at CVSRF

High Density Airports

Space Operations

Seamless integration of national simulation facilities into a virtual validation environment enables rapid prototyping of future ATM concepts and high-fidelity, human-in-the-loop demonstrations

Summary

- We are in the midst of implementing the first level of automation in the aviation system
- By leveraging advances in computing, networking, and CNS capabilities, far greater advances are possible
- Implementing revolutionary systems will be made possible only through the use of state-of-the-art capabilities in system specification and high-fidelity simulation